

Remarks/Arguments:

Pending Claims

Claims 104-123 and 125-127 are pending.

Claims 120 and 127 have been amended to correct minor clerical errors. Independent claims 104, 122, and 126 have been amended to conform to the independent claims of UK Patent 2,395,777 from which the current application claims priority. Claims 104, 122, and 126 have also been amended to clarify the meaning of the recited sets of light intensity data. Claims 104-114, 116, 118, 120, 121, and 127 have been amended to recite functional language in these claims as positive limitations.

No new matter has been added by these amendments. Support for the amendments to claims 104, 122, and 126 is found in the specification at page 6, lines 29-33.

Allowed Claims

Claim 127 has been allowed.

Claim Objections

Claims 111-114 and 118 have been objected to as being dependent on a rejected base claim. Applicants note that claims 119 and 120 are listed as objected to in the Office Action Summary, but are not referred to in the Detailed Action. Applicants assume that the Examiner intended to object to these claims as being dependent on a rejected base claim as well. Applicants respectfully submit that these objections are moot in view of the reasons set forth below, however.

Reconsideration and allowance of claims 111-114 and 118-120 is requested.

Rejections under 35 USC §102(b)

Claims 104-107, 115, 121-123, 125, and 126 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Deck (US 5,953,124). Applicants respectfully submit that this rejection is overcome for the reason set forth below.

Deck discloses interferometric methods and systems that use low coherence illumination and exhibit improved precision and flexibility. Abstract. In these methods and systems, a phase shifting interferometry (PSI) analysis and a scanning white light interferometry (SWLI) analysis are applied to a single 3D interferogram. Abstract. Figure 1 illustrates a system (10) for obtaining interferometric measurements. Column 7, lines 8-9.

This system includes a low coherence source of illumination (12) which produces an incident light beam (14), which is reflected from an optical element (16) towards an interferometric objective or interferometer (18). Column 7, lines 9-13. The interferometer (18)

includes a lens (20) that focuses the incident light beam (14) and a beam splitter (22) that splits the incident light beam into a test light beam (24), which is directed towards a test surface (28) of a test object (29), and a reference light beam (26), which is directed towards a reference surface (30). Column 7, lines 13-19.

A scanning and phase shifting apparatus (32) varies the optical path difference and a phase shift between the test light beam (24) and the reference light beam (26). Column 7, lines 20-23. The scanning velocity is controlled by the computer (33). Column 7, lines 27-28.

The test light beam (24) and the reference light beam (26) are reflected from the test surface (28) and the reference surface (30), respectively, and recombined by the beam splitter (22) so as to form a recombined light beam (34). Column 7, lines 30-34. The recombined light beam (34) is directed towards an imaging array (36) and an interferogram formed by the recombined light beam (34) is imaged thereon. Column 7, lines 37-39.

A frame grabber (38), which is controlled by computer (33), saves data acquired by the imaging array (36). Column 7, lines 47-58. The interference data acquired by the imaging device (36) and saved by the frame grabber (38) is fed directly from the frame grabber (38) to the computer (33), which includes one or more computer programs (for example, in the form of software or firmware) to process the interference data. Column 7, lines 59-65.

The computer (33) processes the interference data to determine a surface height associated with each pixel of the imaging array (36). Column 7, line 66, through column 8, line 30. As shown in Figures 3A and 3B, Deck discloses that intensity curves (51a and 52a) for each pixel in the imaging array may be derived from contrast curves (51b and 52b), i.e. the interference raw data for a single pixel taken over the entire scan. Col. 8, line 50, through Col. 9, line 16. Each set of corresponding intensity and contrast curves (51a/b and 52a/b) shown in Figures 3A and 3B are graphs of intensity as a function of scan (Z) position for a single pixel. Col. 8, lines 50-56, and Col. 9, lines 4 and 5. It is noted that Deck does not disclose that these curves are ever displayed by the system. The surface height associated with each pixel of the imaging array may then be determined from the contrast peaks (P1 and P2) of contrast curves (51b and 52b).

Independent claim 104 recites a feature that is neither disclosed nor suggested by Deck, namely:

...the sensor sensing light intensity at intervals along the measurement path to provide a number of sets of such light intensity data, each set of light intensity data consisting of frame data sensed at one interval along the measurement path;...

...an image enhancer to enhance image data representing one set of light intensity data to be displayed on a display to facilitate the detection by a user of the interference fringes... (Emphasis added.)

Independent claims 122 and 126 include similar features.

The correspondence of each recited "set of light intensity data" to "frame data sensed at one interval along the measurement path" is described in the specification at page 6, lines 29-33. The image enhancer is described generally in the specification at page 18, lines 1-8. Specific examples of this feature are described on pages 18-29 with reference to Figures 9-22. As recited in independent claim 104, this image enhancer "...[facilitates] the detection by a user of the interference fringes," in image data from a single frame (i.e. single interval along the measurement path) that is "...to be displayed on a display..."

In column 7, lines 61-65, Deck discloses that "...computer 33 includes one or more computer programs (for example, in the form of software or firmware) which are executed by a microprocessor of the computer to process the interference data." The Examiner has asserted that the computer may, therefore, be "viewed as an image enhance that is connected to a display." Page 5 of the Office Action, last paragraph. The Examiner has also pointed to the Figures 3A and 3B of Deck as described in Col. 9, lines 4-17, as disclosing image data that is being filtered to remove high frequency interference. Page 2 of the Office Action, last paragraph. The Examiner asserts that this operation, which is carried out by computer 33, constitutes image enhancement. Id. Applicants respectfully disagree.

As described in the specification at page 17, lines 24-33, captured images, i.e. frame data, are displayed so that the user may attempt to detect interference fringes within the image as part of the coarse height adjustment during set up. It is in this context that the recited "enhance[ment of] image data representing one set of light intensity data to be displayed on a display to facilitate the detection by a user of the interference fringes" is performed by the recited image enhancer of claim 104.

As described above, Deck explicitly disclosed that each set of corresponding intensity and contrast curves (51a/b and 52a/b) shown in Figures 3A and 3B are graphs of intensity as a function of scan (Z) position for a single pixel. Col. 8, lines 50-56, and Col. 9, lines 4 and 5. Deck also discloses that intensity curves (51a and 52a) may be filtered to remove rapid intensity variations between the interference data of each pixel at different scan positions, i.e. between different frames of interference data. The purpose of filtering intensity curves (51a and 52a) to derive contrast curves (51b and 52b) from which contrast peaks (P1 and P2) may be determined. Deck does **not** disclose or suggest that either the intensity curves or the contrast curves are ever displayed. The only disclosure by Deck regarding displaying any data is that "...the test surface profile can be displayed in a conventional manner." Column 10, lines 29-30 (emphasis added). Further, Applicants respectfully submit that one skilled in the art would not consider the display of either the intensity curves or the contrast curves to have any advantage in the operation of the interferometric methods and systems of Deck.

On the other hand, the present invention as recited in independent claims 104, 122, and 126, include an image enhancer to enhance "image data representing one set of light intensity data." Emphasis added. As recited in these claims, each set of light intensity data includes light intensity values from the multiple pixels of the sensor all sensed at a single position along the measurement path, i.e. the each recited set of light intensity data "consist[es] of frame data sensed at one interval along the measurement path." Emphasis added.

Therefore, Applicants respectfully submit that Deck does not suggest or teach "...an image enhancer to enhance image data representing one set of light intensity data to be displayed on a display..." as recited in independent claim 104 of the present application.

Based on the reasons set forth above, independent claims 104, 122, and 126 are not subject to rejection under 35 U.S.C. § 102(b) as anticipated by Cohen et al. As claims 105-107, 115, and 121 depend from claim 104 and claims 123 and 125 depend from claim 122, these claims are not subject to this rejection as well.

Rejections under 35 USC §103(a)

Claims 108-110 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Deck in view of Ai et al. (US 5,471,303). Applicants respectfully submit that this rejection is traversed for the reason set forth below.

Ai et al. disclose an interferometric apparatus that combines white-light vertical scanning interferometry and single-wavelength phase scanning interferometry capabilities to improve the accuracy of height measurements in steep regions and in areas with large inter-pixel steps on the test surface. Abstract. Ai et al. do not disclose any means of displaying image data. Therefore, Ai et al. cannot suggest or teach "...an image enhancer to enhance image data... ...to be displayed on a display..." as recited in independent claim 104 of the present application.

Claims 108-110 depend from independent claim 104. Thus, Deck has at least the same deficiencies with regard to claims 108-110 as those described above with regard to claim 104. Ai et al. cannot overcome these deficiencies.

Because there is at least one feature recited in independent claim 104 that is not disclosed or suggested in Deck or Ai et al., singly or in combination, Applicant respectfully submits that this rejection does not set forth a *prima facie* case of obviousness for claims 108-110. Thus, claims 108-110 can not be subject to rejection under 35 U.S.C. § 103(a) as unpatentable over Deck in view of Ai et al.

Claims 116 and 117 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Deck in view of Webster (US 4,040,747). Applicants respectfully submit that this rejection is traversed for the reason set forth below.

Webster discloses an automatic test instrument for gauging the percentage of various constituents in organic substances by comparing the reflective optical density of the subject at various wavelengths. Abstract. Webster does not disclose using image data. Therefore, Webster cannot suggest or teach "...an image enhancer to enhance image data ..." as recited in independent claim 104 of the present application.

Claims 116 and 117 depend from independent claim 104. Thus, Deck has at least the same deficiencies with regard to claims 116 and 117 as those described above with regard to claim 104. Webster cannot overcome these deficiencies.

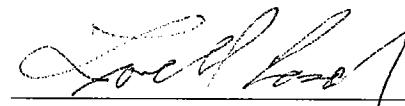
Because there is at least one feature recited in independent claim 104 that is not disclosed or suggested in Deck or Webster, singly or in combination, Applicant respectfully submits that this rejection does not set forth a *prima facie* case of obviousness for claims 116 and 117. Thus, claims 116 and 117 can not be subject to rejection under 35 U.S.C. § 103(a) as unpatentable over Deck in view of Webster.

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Based on the preceding arguments, Applicants respectfully request reconsideration and allowance of claims 104-123 and 125-127.

Respectfully submitted,



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